

CHAPTER 2

SYSTEM CONSIDERATIONS

2.1 INTRODUCTION

A nuclear air cleaning system is an assembly of interrelated, interactive parts that include the air cleaning system components, the contained space served by the air cleaning system (e.g., the glovebox, hot cell, room, or building), and the processes served by that system.

This chapter discusses the design, operational, regulatory, and codes- and standards-related requirements for nuclear facility air cleaning systems. Topics will include system, subsystem, and component design considerations, as well as general descriptions of various systems used in nuclear power plants, fuel processing and reprocessing plants, research facilities, storage facilities, hot cells, gloveboxes, and other applications. This chapter will also consider operating costs and how the design of an air cleaning system directly affects the ventilation system performance and costs. In addition, examples of some of the special considerations (i.e., “lessons learned”) from the design, construction, modification, and operation of nuclear air cleaning systems will be provided.

2.2 ENVIRONMENTAL CONSIDERATIONS

The complexity of the air cleaning system needed to provide satisfactory working conditions for personnel and to prevent the release of radioactive or toxic substances to the atmosphere depends on the following factors.

- Nature of the contaminants to be removed (e.g., radioactivity, toxicity, corrosivity, particle size and size distribution, particle shape, and viscosity)
- Heat
- Moisture

- Other environmental conditions to be controlled
- Probability of an upset or accident
- Extent of hazard in the event of an upset or accident

Environmental parameters are the most important and often understated data required to develop a satisfactory air cleaning system. In designing an air cleaning system, development of the environmental operating conditions must be the first step. Although many individual system components may be environmentally qualified, the designer must consider all environmental parameters on a “system basis.” This may require additional qualification to validate components.

The facility owner or architectural engineering firm normally identifies the design and environmental parameters that are compatible with the overall facility design. These parameters must be identified prior to system design because they must be the basis for the equipment design. If the environmental parameters are carefully considered, a detailed analysis of cost versus long-term operation will provide an environmental maintenance schedule for replacing components and parts throughout the intended operational life of the system. This will ensure that the system will perform its intended function properly, efficiently, and cost-effectively.

TABLE 2.1 lists the most common system environmental parameters to be considered for system design.